

Description of a new species of *Neochalcis* (Hymenoptera: Chalcidoidea) reared from pupa of *Byasa daemonius* (Alphéraky) in Yunnan, China

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Abstract: *Neochalcis daemonius* Xiao, Chen & Zhou sp. nov. (Hymenoptera: Chalcididae: Haltichellinae), a new species reared from the pupa of *Byasa daemonius* (Alphéraky) on *Aristolochia delavayi* Franch. (Piperale: Aristolochiaceae) in Yunnan, is recognized and described based on morphological characters.

Key words: Chalcididae; *Neochalcis*; pupal parasite; taxonomy

达摩麝凤蝶蛹寄生蜂一新种（膜翅目：小蜂总科）

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摘要: 记述截胫小蜂亚科（膜翅目：大腿小蜂科）1 新种：达摩新小蜂 *Neochalcis daemonius* Xiao, Chen & Zhou sp. nov.。该种寄生于贯叶马兜铃上的达摩麝凤蝶蛹。提供了新种的形态描述、分布及外部形态特征图。

关键词: 小蜂科；新小蜂属；蛹寄生；分类

Introduction

Aristolochia delavayi Franch. (Piperale: Aristolochiaceae) is distributed in the dry hot valleys from 1640 m to 2250 m in the Shangri-La Region of Yunnan, China (Yang *et al.* 2014), and is listed on the red list of IUCN as an endangered species. This herb is the most important food source for the larvae of *Byasa daemonius* (Alphéraky) (Lepidoptera: Papilionidae), which heavily rely on *A. delavayi* to complete their life history (Figs. 1, 2) (Chen *et al.* 2015). This butterfly is listed as a vulnerable species on the Chinese Red List (Wang & Xie 2004). During exploring the ecological interactions between *A. delavayi* Franch. and *B. daemonius* (Alphéraky) in the Shangri-La Region, individuals of *Neochalcis* sp. (Fig. 6) (Hymenoptera: Chalcididae) were reared from the pupae of *B. daemonius* (Figs. 4, 5). This wasp was found to

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lay eggs on the prepupae of *B. daemonius* (Fig. 3) and is identified as a new species of *Neochalcis*.

The genus *Neochalcis* was originally placed in Chalcidinae (Chalcididae) by Kirby (Kirby 1883) with *Halticella osmicida* Saunders designated as the type species. Several researchers studied this genus and placed it in the Chalcidinae (Dalla Torre 1898; Ashmead 1904; Schmiedeknecht 1909; Masi 1929). Bouček (1952) put *Neochalcis* in the Haltichellinae (Chalcididae) and synonymized *Orthochalcis* Kieffer, 1905 as a junior synonym. Subsequently, Narendran (1984) added *Eugastrochalcis* Masi, 1929 as a new synonym.

The genus *Neochalcis* shares the following characters with other genera of the Haltichellinae (Chalcidoidea: Chalcididae): apex of metatibia almost perpendicularly truncate or slightly sinuate and with two apical spurs, hind femur ventrally with short or long comb of dense minute denticles mostly on lobes. This genus is close to the genera *Haltichella* and *Hockeria* (Chalcididae: Haltichellinae: Haltichellini) having a marginal vein nearing the margin of fore wing and the postmarginal vein distinctly developed. But *Neochalcis* can be separated from *Hockeria* by the hind tibia with an additional carina (absent in *Hockeria*), frons with preorbital absent (weak in *Hockeria*), abdomen with conspicuous pubescence (without pubescence in *Hockeria*) and antenna with scape not reaching the anterior ocellus (scape reaches the anterior ocellus in *Hockeria*). The differences of *Neochalcis* and *Haltichella* are: posterior margin of scutellum with two short teeth (two horizontal, parallel spinous dents in *Haltichella*), Gt₁ anteriorly without longitudinal carina (with 2 short longitudinal carinae in *Haltichella*) and ventral margin of posterior femora with one distinct dent (without dent in *Haltichella*).

Until recently, a total of 10 valid species have been reported, of which 7 are known from the Palearctic Region, 3 from the Oriental Region and 1 from the Afrotropical Region (Noyes 2016). There have not been any species reported from China except for the genus mentioned in a study on the phylogenetic relationships of Chinese Chalcididae (Yang & Liu 2006). Here one new species, *Neochalcis daemonius* sp. nov., based on morphological characters, is added to the fauna of China.

Material and methods

All pupae of *Byasa daemonius* (Alphéraky) were collected in Hutiao Gorge, Jinsha River, Yunnan, China, in early June of 2009, 2011 and 2013. The first wasp emerged after 16 days. About thirteen to forty-seven wasps emerged from one pupa. All of the specimens were collected and preserved in 95% ethanol for further morphological studies. Ethanol-preserved specimens were subsequently air dried, point-mounted, and examined with a Nikon SMZ1500 stereomicroscope. Photographs were obtained under the Nikon Multizoom AZ100 system, and the plates were compiled using Adobe Photoshop CS3 software.

Morphological terminology follows that of Bouček (1988) and Gibson *et al.* (1997). Body length excludes the ovipositor and is measured in millimeters (mm). The other measurements are given as ratios. Abbreviations of morphological terms used are: fu_n — funicular segment; POL — posterior ocellar distance; OOL — ocellocular distance; Gt_n — gastral tergum.

Type specimens of this newly described species are deposited in the Institute of Zoology, Chinese Academy of Sciences, Beijing, China (IZCAS) and the Kunming Institute of Botany, Chinese Academy of Sciences, Kunming, China (KIBCAS).

Taxonomy

Genus *Neochalcis* Kirby, 1833

Neochalcis Kirby, 1883: 63. Type-species: *Halticella osmicida* Saunders, 1873, by monotypy; Dalla Torre, 1898: 401; Ashmead, 1904: 255.

Orthochalcis Kieffer, 1905: 265. Type-species: *Euchalcis fertoni* Kieffer, 1899, by monotypy; Schmiedeknecht, 1909: 52. Synonymized by Bouček, 1952: 40.

Eugastrochalcis Masi, 1929: 181. Type-species: *Eugastrochalcis breviceps* Masi, 1929, by monotypy. Synonymized by Narendran, 1984: 435; Narendran, 1989: 80.

Diagnosis. Antennae short; eyes sparsely or densely pubescent; preorbital and postorbital carina weak or absent; antennal scrobe relatively shallow, not reaching anterior ocellus (Fig. 8); antenna inserted at lower face, lower margin of torulus below lower ocular line, a small distance above the clypeus; face with densely coarse punctures; malar sulcus distinct; occipital carina absent; head and thorax closely punctured, mesosoma convex; notauli complete; scutellum with two dents at the end (Figs. 12, 13), flatly lobate and short; ventral margin of posterior femora with 1 distinct dent in the middle of the lower margin, behind it a second dent is indicated by the convex course of the comb; hind tibia with 2 external long longitudinal carinae (Fig. 15); fore wing with postmarginal vein developed, at least as long as marginal vein; gaster subsessile to petiole distinct; gaster conical, acuminate at apex, Gt_1 large and anteriorly without longitudinal carina, about three-fifths of gaster length.

Biological notes. The species of *Neochalcis* seem to be hyperparasitoids attacking the larvae or pupae of their hosts including *Ceratina flavipes* (Hymenoptera: Apoidea), *Osmia tridentata* (Hymenoptera: Apoidea), *Plutella xylostella* (Lepidoptera: Plutellidae), *Scythris monochreella* (Lepidoptera: Scythrididae) and Myrmeleontidae (Neuroptera) (Noyes 2002). In our investigation, this new species was reared from pupae of *Byasa daemonius* (Alphéraky) (Lepidoptera: Papilionidae).

Distribution. China (Yunnan); Palearctic, Oriental and Afrotropical Regions (Noyes 2016).

Neochalcis daemonius Xiao, Chen & Zhou sp. nov.

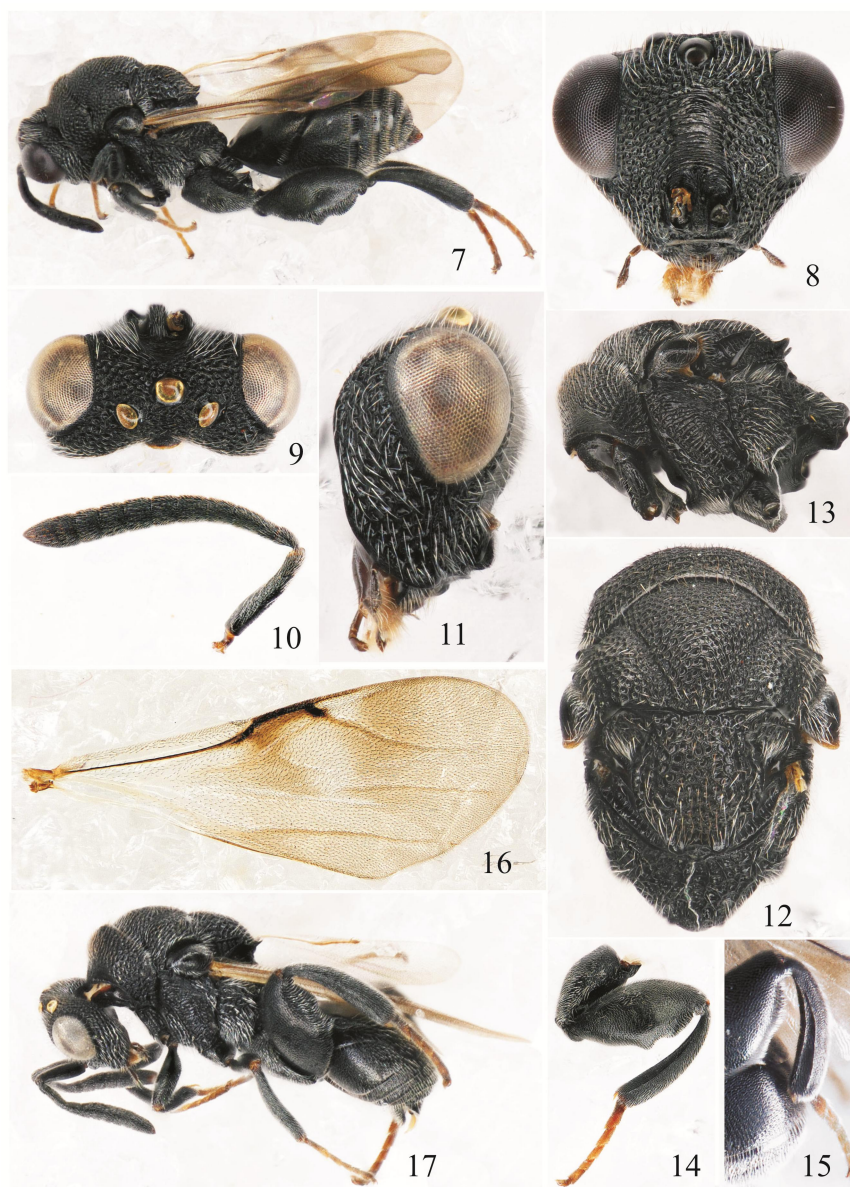
Description. Female. Body (Fig. 7) length 3.3–4.2 mm, black with coarse punctations and densely silver pubescence; eyes pale white and densely pubescent, ocellus hyaline. Antennae black except ventral margin of clavae yellowish; tegula black, wings hyaline, pale brown with veins dark brown; legs concolorous with body except fore tarsi and mid tarsi yellow, hind tarsi yellowish brown and claws brown; epipygium and ovipositor sheaths brown.

Head in front view (Fig. 8) about $1.5\times$ as broad as high; head height $1.57\times$ as long as eye height; eye space $0.79\times$ as long as eye height; inner margin of eyes not parallel; face with coarse punctations and silver pubescence, interspaces of punctations with small fine lines; preorbital carina absent; posterior margin of gena concaved and outer margins assembled towards middle part; antennal scrobe relatively deep with densely transversal wrinkle, not

reaching anterior ocellus; interantennal area with arcuately protuberant longitudinal carinae, thick and short; malar space about 0.44 times of eye height; antennal insertion at lower face, lower margin of torulus below lower ocular line, a small distance above clypeus; clypeus small with upper margin prominent and lower margin truncate; mandibles black, both 2-toothed. Head in lateral view (Fig. 11), eyes large, about $1.27\times$ as long as broad; postorbital carina absent; malar sulcus distinct. Antennal formula 11173 (Fig. 10); scape nearly as long as eye height, not reaching lower margin of anterior ocellus; pedicel and flagellum combined almost as long as head width; pedicel length about 2 times of its width; anellus $0.6\times$ as long as broad; fu_1 longer than all other funicular segments, about $1.25\times$ as long as broad, the following funicular segment lengths decreasing accompanied by increasing width; fu_3 – fu_7 wider than length, fu_5 – fu_7 combined longer than clava length, clava clavate, segments inconspicuous; venter margin of clava with yellowish oblique plane, without micropilosity area. Head in dorsal view (Fig. 9), frons concaved in the middle, both sides at equal level of eyes; head about $2.6\times$ as broad as long; occipital carina absent; anterior ocellus and posterior ocelli on obtuse angle; POL $2.75\times$ OOL.



Figures 1–6. 1. *Byasa daemonius* (Alphéraky); 2. Larva of *B. daemonius* on *Aristolochia delavayi* Franch; 3. *Neochalcis daemonius* Xiao, Chen & Zhou sp. nov. laying eggs on prepupa of *B. daemonius*; 4. Pupae of *B. daemonius*; 5. *Neochalcis daemonius* Xiao, Chen & Zhou sp. nov. reared from pupae of *B. daemonius*; 6. Pupae of *Neochalcis daemonius* Xiao, Chen & Zhou sp. nov.



Figures 7–17. *Neochalcis daemonius* Xiao, Chen & Zhou sp. nov. 7–15. Female. 7. Body, lateral view; 8. Head, frontal view; 9. Head, dorsal view; 10. Antenna, lateral view; 11. Head, lateral view; 12. Thorax, dorsal view; 13. Thorax, lateral view; 14. Leg, lateral view; 15. Hind tibia, lateral view; 16. Fore wing; 17. Male body, lateral view.

Thoracic dorsum convex and with densely coarse punctation (Figs. 12, 13); mesosoma slightly wider than head width, about $1.24\times$ as long as broad. Pronotum with large collar, about $2.6\times$ as broad as long, about $0.79\times$ as broad as mesoscutum; mesoscutum about $1.83\times$ as broad as long; notauli complete; scutellum nearly as long as broad, lateral and apical margin widely explanate and folded upwards, apex well bilobed, flatly and shortly; propodeum long with strongly raised wrinkle, outer margins assembled towards posterior part, nodular bump in

apical part, middle length of propodeum about $0.77\times$ as long as scutellum, submedian carina and sublateral carina distinct, median carina absent. Fore wing densely hairy (Fig. 16), about $2.5\times$ as long as broad; postmarginal vein distinctly developed, longer than marginal vein, about $3\times$ as long as stigmal vein; submarginal vein : marginal vein : postmarginal vein : stigmal vein as $3.5 : 0.7 : 1 : 1.2 : 0.4$. Ventral margin of posterior femora with a distinct dent in the middle of the lower margin, behind it a second dent is indicated by the convex course of the comb (Fig. 14); hind tibia with 2 longitudinal carina (Fig. 15).

Metasoma with petiole transverse, about 0.5 times as long as broad in dorsal view; gaster with dense punctation, interspaces of punctation smooth; gaster conical, about $1.56\times$ as long as broad, gaster shorter than mesosoma, gaster width slightly narrower than mesoscutum width; Gt_1 large and anteriorly with longitudinal carinae, nearly as long as broad, about three-fifths of gaster length, posterior margin roundly protrudent; ovipositor sheath extending.

Male. Body length 3.1–3.5 mm (Fig. 17). Antennae stout, fu_1 – fu_3 length decreasing accompany with width increasing, fu_4 – fu_7 with same width; clava not clavate, 3 segments with equal width, about as broad as fu_3 ; gena strongly assembled towards middle part; fore wings brownish; tarsi dark brown; gaster conical, about 2 times as long as broad; other characters same as in female.

Holotype. ♀ (IZCAS), **China**, Yunnan, Hutiao Gorge, 1640–2250 m, VII-2013, Coll. Gao CHEN, ex. pupae of *Byasa daemonius* (Alphéraky). **Paratypes.** 76♀3♂ (IZCAS, KIBCAS), **China**, Yunnan, Hutiao Gorge, 1640–2250 m, VII-2013, Coll. Gao CHEN, ex. pupae of *Byasa daemonius* (Alphéraky).

Etymology. The specific epithet is from the host *Byasa daemonius* (Alphéraky).

Distribution. China (Yunnan).

Biology. These wasps were reared from pupae of *Byasa daemonius* (Alphéraky) (Lepidoptera: Papilionidae). The wasps prefer to lay eggs on the prepupae of *B. daemonius* (Alphéraky) and thirteen to 47 wasps emerged from one pupa (Figs. 3–5).

Remarks. This new species resembles *Neochalcis hockerioides* (Bouček) with the pedicel length relatively longer ($2\times$ as long as its width) and the eyes with white pubescence. But it can be distinguished from the latter by the following characters: scape not reaching lower margin of anterior ocellus (scape reaches to the anterior ocellus in *N. hockerioides*), postmarginal vein $3\times$ as long as stigmal vein (as long as stigma vein in *N. hockerioides*), and body length distinctly shorter than that of *N. hockerioides*.

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